A DECADE OF OCEAN CONSERVATION:

Key Findings from the First Review of California's Marine Protected Area Network

Photo: Abalone survey in Sea Lion Cove SMCA - Chenchen Shen CDFW.

CALIFORNIA MARINE PROTECTED AREAS

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GOAL 1: Protect the natural diversity and abundance of marine life, and the structure, function, and integrity of marine ecosystems.

GOAL 2: Help sustain, conserve, and protect marine life populations, including those of economic value, and rebuild those that are depleted.

GOAL 3: Improve recreational, educational, and study opportunities provided by marine ecosystems that are subject to minimal human disturbance, and to manage these uses in a manner consistent with protecting biodiversity.

GOAL 4: Protect marine natural heritage, including protection of representative and unique marine life habitats in California waters for their intrinsic value.

GOAL 5: Ensure California's MPAs have clearly defined objectives, effective management measures, and adequate enforcement, and are based on sound scientific guidelines.

GOAL 6: Ensure the state's MPAs are designed and managed, to the extent possible, as a network.

Figure 1.2 The six goals of the Marine Life Protection Act (Fish and Game Code 2853).

Top: Giant kelp in Point Sur SMR-Anna Neumann CC. Copper rockfish in Portuguese Ledge SMCA-MARE. Recreational divers accessing Laguna Beach SMR-Steve Wertz CDFW. Gray whale in Southeast Farallon Island SMR-nbawill CC. NC ROV Survey in Reading Rock SMR-Adam Frimodig CDFW. Octopus in Southeast Farallon Island SMR-MARE.

INTRODUCTION

California made conservation history in 1999 when the State Legislature passed the Marine Life Protection Act (MLPA). This law required that California establish an ecologically connected network of marine protected areas (MPAs) along its coast. The MLPA also established six key goals for the MPA Network. In 2012, following a science-based and community-driven planning process that began in 2004, California implemented a Network of 124 MPAs that spans the state's entire 1,100-mile coastline and protects 16% of state waters. Management of the Network is guided by a comprehensive adaptive management program that includes a requirement to review progress toward MLPA goals every ten years and is composed of **four key pillars: research and monitoring, outreach and education, policy and permitting, and enforcement and compliance**. After a decade of ocean conservation, this first Decadal Management Review (Review) of the MPA Network and Management Program provides an opportunity to celebrate achievements, reflect on challenges, and identify critical knowledge gaps and recommendations for the next ten years of MPA management.

The MPA Management Program's three-stage approach to the adaptive management process.

RESEARCH & MONITORING

The MPA Monitoring Program was designed to examine the effects of MPA protection on individual species and habitats, as well as on coastal human communities. Monitoring is conducted by research consortiums that bring together scientific experts from across the state. Community science programs and tribal partnerships also contribute valuable scientific data and allow for broader participation in MPA monitoring.

RESEARCH & MONITORING HIGHLIGHTS

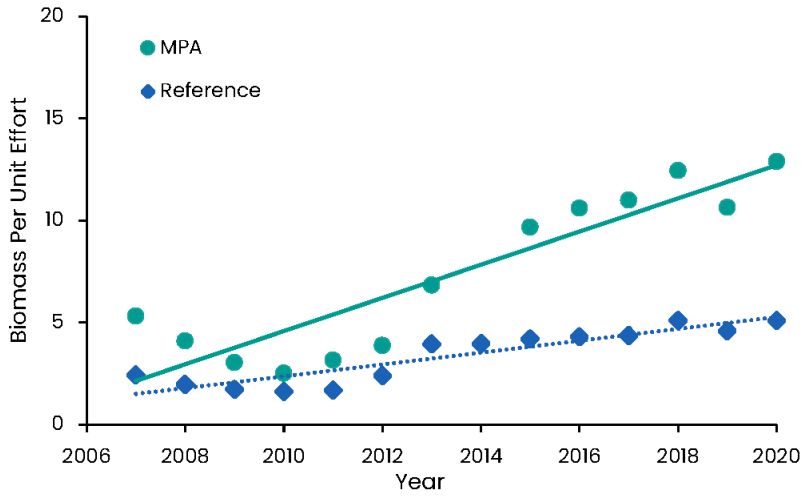
The Review presents a snapshot of information collected in nearshore habitats and coastal communities across California during baseline and long-term monitoring. Highlights from each habitat include:

- **Sandy beach and surf zone:** Differences between surf zone fish abundances inside and outside MPAs varied across bioregions, species groups, and survey methods. However, the abundance and species richness of fish observed through baited remote underwater videos was higher inside MPAs than in reference sites. (https://bit.ly/OPC-SS1)
- **Rocky intertidal:** Species diversity in rocky intertidal habitats was higher inside MPAs over time than reference sites. In response to the 2014-2016 marine heatwave, intertidal communities inside MPAs were more stable over time than reference sites, both during and after the heatwave. (https://bit.ly/OPC-SS2)
- **Kelp forests and shallow rocky reefs:** Fish populations in MPAs experienced the strongest positive responses to protection in regions where more fishing occurred prior to protection, in particular the south coast. Fished species in southern California were bigger and more abundant inside MPAs than non-fished species. (https://bit.ly/OPC-SS3)
- **Nearshore rocky reefs:** Fish were bigger and more abundant inside MPAs than in reference sites across the state. More than 70% of fish species observed were larger in both size and numbers inside MPAs. Larger MPAs showed greater increases in the abundance and biomass of fish than smaller MPAs. (https://bit.ly/OPC-SS4)
- **Mid-depth and deep reefs:** Overall, the quality of rocky habitat was similar between MPAs and reference sites. In general, fish abundances increased across the state both inside and outside MPAs, in part due to good recruitment years and other fishery management actions such as Rockfish Conservation Areas that complement protection in MPAs. (https://bit.ly/OPC-SS5)

» **Estuaries and coastal marsh habitats:** Physical metrics such as temperature and salinity varied within and across regions, types of estuaries, and seasons. Estuary conditions and species composition were largely driven by whether the estuary mouth at the transition zone to the ocean was open or closed. (https://bit.ly/OPC-SS6)

» **Nearshore oceanographic conditions:** MPAs and reference sites experienced similar ocean conditions within bioregions; across bioregions, however, ocean conditions in the south coast, including the Channel Islands, were more varied than in the north or central coasts. Historic and future model projections showed that MPAs statewide protect higher percentages of habitats that could provide climate refugia compared to other state waters. (https://bit.ly/OPC-SS7)

» **Commercial fishing community:** Out of the 85 commercial fishermen and 20 Commercial Passenger Fishing Vessel operators who participated in focus group meetings, most felt that MPAs have had a negative effect on marine resources as well as fishermen's livelihoods and well-being. (https://bit.ly/OPC-SS8)



Increase in fish biomass over time in MPAs and reference sites observed in California Collaborative Fishing Research Program surveys on the central coast.

KEY RECOMMENDATIONS

» Update the MPA Monitoring Action Plan framework to develop and sustain a cost-effective long-term monitoring program, including guidelines to ensure monitoring consistency and sustainable funding.

» Invest in improving understanding of the human dimensions of MPAs and develop a human dimensions working group and research agenda.

» Explore the use of innovative technologies such as remote sensing, drones, and eDNA to enhance and streamline traditional monitoring projects.

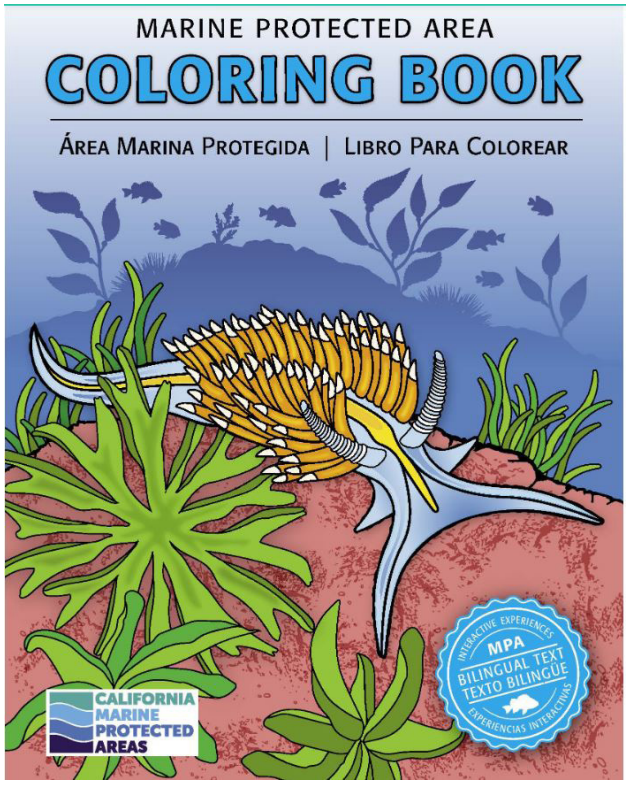
» Develop a comprehensive community science strategy for MPAs and better utilize community science to supplement core monitoring programs.

OUTREACH & EDUCATION

MPA outreach and education focuses on building public awareness of MPA locations and regulations, as well as the benefits of MPAs and opportunities to get involved in MPA management. Through these efforts, the MPA Management Program aims to improve regulatory compliance and foster a sense of coastal stewardship among all Californians.

OUTREACH & EDUCATION HIGHLIGHTS

- A wide variety of tools are being used by MPA managers and partners in outreach and education efforts, including: signage, brochures, posters, websites and blogs, California Department of Fish and Wildlife's (CDFW) ocean sport fishing interactive web map, mobile apps, webinars and videos, virtual field trips, and online training courses.
- Efforts to make MPA outreach and education resources available in Spanish and other languages in California facilitate the distribution of MPA information to wider audiences and promote justice, equity, diversity, and inclusion.
- The MPA Collaborative Network is a group of fourteen grassroots MPA Collaboratives across the state that provide a bottom-up, localized, and participatory approach to MPA management. Collaboratives across the state have developed numerous locally-relevant outreach products (https://bit.ly/MPAC-PL), including county-scale MPA brochures and videos, kids' coloring books and activity guides, lesson plans for teachers, an online MPA training course, and videos about California Native Americans' long history of coastal resource stewardship.



» Engagement with the public was a priority leading up to the Review. Opportunities for public input included the launch of a dedicated Review website (https://bit.ly/CDFW-DMR) by CDFW and two virtual engagement series: four statewide community meetings (https://bit.ly/DMR-CM) to solicit input and comments from the public, and an eight-part webinar series called "Ask the Researcher" (https://bit.ly/OPC-ATR) designed to connect the public directly with MPA scientists for deep dives into monitoring results.

KEY RECOMMENDATIONS

» Evaluate outreach and education needs, assess effectiveness of resources, and identify and pursue the most impactful cost-efficient outreach tools for increasing MPA awareness and compliance.

» Conduct more targeted outreach to specific audiences to connect stakeholders with coastal resources and to encourage stewardship and compliance with regulations.

POLICY & PERMITTING

MPA policy and permitting helps to ensure that activities allowed within MPAs—especially those activities that may result in some disturbance to species and habitats — are consistent with the goals of the Network. Effective policy and permitting helps to maintain ecosystem protections while allowing the MPA Network to serve scientific, educational, and cultural purposes.

POLICY & PERMITTING HIGHLIGHTS

- Clarification and refinement of MPA policy and regulations, such as allowing tribal take and ensuring human health and safety, is an integral part of adaptive management. Since the completion of the Network, regulations have been changed to allow tribal take at several south coast and north coast MPAs.
- The California Ocean Protection Council receives mitigation payments from power plants to offset negative environmental impacts from once-through cooling, which it uses to fund MPA Management Program priorities.
- CDFW's Scientific Collecting Permit (SCP) Program regulates take in MPAs for research and education purposes to manage these uses in a manner consistent with protecting biodiversity. From 2012 to November 1, 2022, 907 scientific collecting permits were issued for activities within MPAs.

Total number of SCPs issued for work inside and outside the MPA Network from 2012 to November 1, 2022. The dashed line represents the creation of the SCP Portal.

» Key next steps for MPA policy and permitting include addressing stakeholder concerns about barriers to restoration in MPAs and improving the Scientific Collecting Permit Program.

KEY RECOMMENDATIONS

» Improve the application and approval process for scientific collecting permits.

» Develop a framework to evaluate and approve appropriate restoration and mitigation actions within MPAs.

ENFORCEMENT & COMPLIANCE

MPA success relies upon effective enforcement of MPA laws and regulations. CDFW's Law Enforcement Division works in partnership with allied agencies such as the National Oceanic and Atmospheric Administration, the National Park Service, State Parks, the United States Coast Guard, county sheriffs, and the California Highway Patrol to enforce MPA regulations.

ENFORCEMENT & COMPLIANCE HIGHLIGHTS

» Approximately 50 wildlife officers and seven large offshore patrol boats are currently focused on enforcing marine laws and regulations, including those pertaining to MPAs.

» CDFW has implemented a digital enforcement records management system to track resource violations. From January 2016 to December 2021, approximately 16,634 citations were written for 21,059 marine-related violations, of which 2,792 citations were written for 3,468 violations occurring within MPAs.

» From January 2016 to December 2021, CDFW recorded violations within 91 of the 124 MPAs, with most violations occurring in southern California. Increased violations occur around more populated areas.

» Partners are eager to help with MPA enforcement and compliance, and CDFW offers assistance to allied agencies who request help or insight on conducting marine enforcement. From 2019 to 2022, the MPA Collaborative Network conducted an MPA Compliance Priorities Workshop and Enforcement Training for Allied Agency Officers in each of California's coastal counties.

KEY RECOMMENDATIONS

» Create and implement a cohesive and actionable MPA Enforcement Plan.

» Increase enforcement capacity.

» Enhance MPA citation record keeping and data management.

» Increase information gathering regarding MPA violation prosecutions and judicial outcomes.

MPA NETWORK PERFORMANCE

California's MPA Network currently presents one of the only opportunities in the world to examine the benefits of a large-scale, ecologically connected network of MPAs. By taking a holistic approach, this Review has helped to identify important patterns and trends emerging across the statewide Network.

Map of the three bioregions delineated by distinct changes in ecological communities: north (California/Oregon border to San Francisco Bay, including the Farallon islands), central (San Francisco Bay to Point Conception), and south (Point Conception to the California/Mexico border). Top to bottom: Bull kelp, school of blue rockfish, and spiny lobster — CDFW.

NETWORK PERFORMANCE HIGHLIGHTS

» Fish biomass: The overall biomass of fished species is higher inside MPAs than areas outside across most of the state; this response was most significant in the south coast bioregion where historical fishing pressure is higher and is likely driving the combined statewide trends.

» Climate resiliency: MPAs did not appear to help mitigate against the initial effects of the marine heatwave, yet some ecological communities within MPAs appeared to be more resilient and showed signs of recovery after the heatwave.

» Connectivity: Rocky intertidal, kelp forest, and mid-depth rocky reef habitats inside MPAs are more connected to each other, and to other parts of the coast, than areas outside of MPAs

» Ecological performance: MPA response varies across and within bioregions, habitats, depths, species, and survey method. Species- and community-level responses were strongest in the central and south coast regions in most habitats.

» Human engagement: Human use of MPAs, including recreation and scientific surveys, was largely driven by population density; however, certain site characteristics (e.g., proximity to State Parks and sandy beaches), expand human engagement in more remote MPAs.

KEY RECOMMENDATIONS

» Develop and implement climate change research and monitoring priorities and metrics for California's MPA Network.

» Further integrate influencing factors, such as environmental conditions, into ecological and human study designs and interpretations of MPA performance.

Research diver doing a kelp survey — Kate Vylet, CDFW.

CONCLUSION

This first Review of California's MPA Network is a milestone. While much has been achieved to meet the goals of the MLPA, there is room to adapt the MPA Management Program to address the knowledge gaps and challenges identified in the Review. The partnership-based approach is a cornerstone of MPA management, without which the accomplishments shared in the Review could not have been realized. As California strives to meet its conservations targets, including protecting 30% of our coast and oceans by 2030 (https://bit.ly/CNRA-30x30), the MPA Network serves as a strong foundation to protect our coastal and marine biodiversity.

RESOURCES

California's Marine Protected Area Network Decadal Management Review https://wildlife.ca.gov/MPADecadalReview

A Synthesis of Ecological and Social Outcomes from the California Marine Protected Area Network https://bit.ly/NCEAS

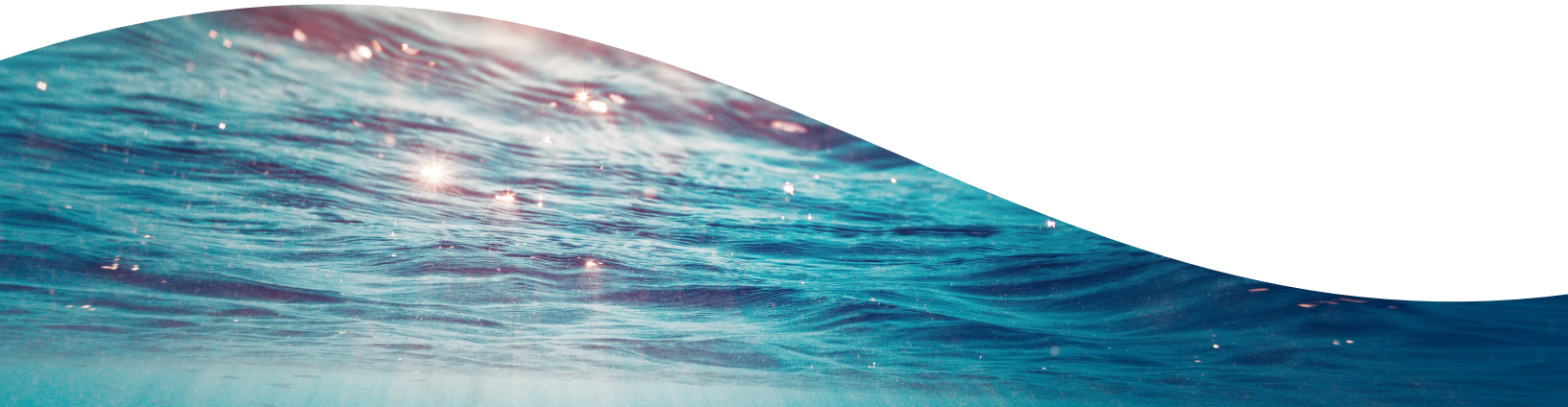


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Photo: Ocean surface - CDFW.

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